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NOTES ON

The Geology of some Islands

IN LAKE WINNIPEG,

—BY—

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NOTES ON THE GEOLOGY OF SOME ISLANDS IN LAKE WINNIPEG.

—BY—

J. HOYES PANTON, M. A., F. G. S., Guelph, Ont.

On a former occasion, I had the honor of reading a paper before the members of the Historical and Scientific Society, of Manitoba, on "Outcrops of Silurian Strata in the Red River Valley." To-night I purpose directing your attention to some exposures of rock on the islands in Lake Winnipeg.

When Prof. Hind undertook his geological investigation about the year 1857, he visited some of these; but my attention to them was chiefly directed in the summer of 1884. The results of his researches I shall to some extent embody in this paper, along with those of my own efforts in that locality.

Lake Winnipeg may be said to commence about 40 miles north of the city of Winnipeg and forms an outlet for the Red River, whose muddy waters exercise a coloring influence upon it for nearly 150 miles; beyond this the water of the lake is comparatively clear. The lake is naturally divided into two parts; the lower about one hundred miles in length and 30 in width. This portion narrows in the upper end until the opposite shores approach each other within three miles and form a strait for the distance of 8 miles, where the narrowest space is reached at Dog's Head; here the passage is only two miles in width. At this point you pass into the upper division and main portion of the lake.

This is about 200 miles in length and 60 in width. Considered as whole the lake may be said to be 300 miles long and 60 at its widest part, embracing an area of 8,500 square miles and not exceeding 65 feet in depth. The islands scattered over this body of water will afford many interesting localities for geological visits by the energetic members of this society. Here we find opposite shores presenting rocks belonging to entirely different systems; the east side Laurentian, the west Silurian; here too are excellent lessons of the denudating effect of water on limestone in striking contrast with the slow disintegration of rocks belonging to an older series under the same conditions.

The shallowness of this comparatively large body of water, accounts for its treacherous nature and explains how on many

occasions it has proved a disastrous waterway to the freighting boats of bye-gone days.

As you sit upon the deck of the steamer, threading its way among the islands, you are surprised at the tortuous course made, when water seems on every side and no shore near. So shallow is the lake that many places miles from land are not covered with more than six or seven feet of water. It is only safe to experienced captains, thoroughly acquainted with the concealed channels that afford a safe course at a distance from the shore. Captain Duncan, of the steamer Princess, informed me that there is a greater tendency for the west coast to assume a shelving condition than the east; this is likely on account of the rocks on that side being limestone in thin layers, while those of the east are more or less of a granitic nature.

The thin layers of the former split up readily and by the action of ice soon break up and form large shallow areas bordered by immense piles of shingle, which in time disintegrate, gradually wash away and the waters encroach upon the land. An examination of the map shows there is a tendency for the lake to work westward, while there seems to be little advance made in the disintegration of the rocks along the eastern shore.

This fact seems to have been overlooked by some in accounting for the northwest position of the lake by attributing it to glacial action. While this may have done something in giving the lake this direction, still much of its present outline on the west coast is due to more modern agencies.

Two or three hours' sail from the mouth of the Red River up the east coast and the Winnipeg River is reached, well defined in striking contrast to that of the Red. Its banks are comparatively high, especially the north; the waters maintain their clearness for considerable distance out in the lake, until they become thoroughly mixed with the muddy water which characterizes the lake for nearly two thirds of its length. Their clearness is due no doubt to the fact that the latter flows over a rocky channel and gathers but little sediment from the exposures of Laurentian rock which in many places forms its banks.

An interesting fact in connection with the river is that on the south side for some miles from the lake the limestone formation ends, while on the north the Laurentian begins. Passing up the lake from the mouth of this attractive river and sailing north-westerly you come to several islands worthy

of more than passing notice, viz.: Big, Big Black, Deer and Punk Islands.

BIG ISLAND

has already been a source of considerable interest to some investigators who have discovered upon it valuable beds of iron ore. It presents a striking peculiarity in possessing outcrops of both the Laurentian and Silurian systems; the latter is characteristic of all the other islands except those very few close to the eastern shore, where Laurentian rocks are common. On the east side of Big Island the beds of iron ore are located from which many excellent specimens have been obtained that present physical character common to rich ores and also under the crucial test of the analyst have proved to be of more than ordinary value. On the west side an extensive outcrop of limestone occurs. The proximity of limestone to these large beds of ore is of great practical importance and gives a value to the iron deposits they otherwise would not possess.

A short distance from this, Deer Island is situated. It was visited by Hind in 1858, who made geological examination of its rocks and reported upon them as follows:—

DEER ISLAND.

Commencing at the water edge.

1. The beach covered with shingle resulting from worn fragments of the limestone of the island.

2. Four feet of dark green argillo-arenaceous shale with thin layers of sandstones. Fucoids very abundant in this layer. The sandstone becomes reddish brown on weathering; but a fresh surface is white or gray. Iron pyrites (iron sulphide) in the form of disk shape nodules and some shells also occur.

Fossils of the genus modiolopsis are common in the shale: this genus I may add is well represented in the limestone along the lake shore west of Toronto and generally accepted as belonging to the Hudson River group of Silurian rocks.

3. Resembles the preceding; the sandstone layers are from 1 to 4 inches in thickness and predominate over the shaly portions. Its thickness is 6 feet and some parts of the formation vary considerably.

4. Ten feet of sandstone with green bands of a soft argillaceous rock, from $\frac{1}{4}$ to 4 inches in thickness.

The sandstone is generally red, but sometimes white. A

green band, a few inches thick, filled with obscure forms resembling fucoids, is very characteristic.

5. Eighteen feet of limestone, horizontal, very hard and breaks off the cliff where the soft sand stone has been weathered in huge rhomboidal slabs 8-25 feet in diameter and 4-10 inches thick. The surface of the limestone shows silicified shells and corals.

Among the shells an Orthoceras 9 inches in diameter was observed, with fossils belonging to the genera Rhynchonella and Tetradium. In the shingle below the cliff Orthoceratites were common and along with them a specimen of Maclurea and one of Halysites Catenulata and chain coral

Six miles north of Deer Island

GRINDSTONE POINT

is reached. Here the rocks are similar to those on Deer Island but the exposure is higher and the sandstone bands more fully shown. Beneath the layer which corresponds to No. 2 of the island, a hard, yellow, compact sandstone is exposed for a space of four feet above the level of the water.

No. 2 and 3 differ slightly; the sandstone bands are thicker; the green shaly portion more distinct as a separate band, and two feet thick; while above the hard yellow sandstone, the base of No. 2, appears in the form of a purple band of very soft sandstone one foot thick containing many stains, apparently caused by fucoids.

The rock for several miles around this point is much the same. On Punk Island, in the vicinity, a yellow ochre occurs between the layers of stone and when burned gives a beautiful red; the limestone in which it occurs is comparatively porous.

One hundred miles from the mouth of Red River, after passing through a narrow channel at Dog's Head and sailing some four miles to the north,

BLACK BEAR ISLAND

is reached. This is a beautiful spot, presenting many attractions to the tourist, and an excellent harbor to anyone overtaken by storm on this treacherous lake. The steamer on which we sailed up the lake lying here to take wood, afforded an excellent opportunity to examine the rocks of the island. This is about five miles in circumference and presents three good exposures of rock, especially on the north-west side; each forming the shore of a bay, formed by the storms which fre-

quenty beat on this side. But by far the best defined bay and most suitable for affording a place of safety during storms is that found on the south side of the island.

In this quiet haven many a boat has found protection when to continue a voyage on the lake meant certain disaster.

The inlets on the north shore are bordered by immense heaps of shingle formed from the layers of rock as they break up into fragments along the weather beaten shore.

The largest outcrop is seen in the middle bay where the rock is fully twelve feet thick, extending in great steps to the shore; the lower being covered with shingle. The steps are usually about a foot in thickness, but each is made up of thin layers about two inches thick. Fossils are not very numerous and those found restricted to a few species.

Fucoids are represented by innumerable impressions; several specimens of the genus Maclurea were found, the largest being 6½ inches in diameter and the least 4. These forms were more common in the upper layers than in the lower. Two obscure brachiopods were observed and two forms belonging to the genus Pleurotomaria. The Orthoceras and Endoceras seem to have been the leading types of life when these deposits were laid down. These extinct members of the cuttlefish family are represented by several large forms on the shores of this island. One large specimen obtained here is now in the Provincial museum. Some were observed five feet in length and 4½ inches in diameter. No corals were seen except a very obscure fossil which was so water worn that it could not be identified; in some respects it bears a striking resemblance to an imperfect specimen of the doubtful genus Stromatopora for which it was at first taken.

A few crinoid stems could be seen in some of the rock fragments.

The surface of the solid rock which skirts the first bay shows excellent traces of glacial action; the *striae* indicating a n. ne. direction in some places crossed by markings n. nw.

Boulders of Gneiss are common, some of which are very angular. On the east side of the island the rock is thicker and more compact but comparatively fossiliferous below; the rock is a dolomitic limestone, harder than that at Selkirk and probably containing more magnesia; portions of it present a mottled appearance not unlike limestone of the Red River Valley already referred to in my papers on Silurian Outcrops in that district.

Having had an opportunity of visiting this island twice and on both occasions sufficient time to examine the back of it, where the most characteristic outcrops appear, what I have written may be taken as representing at least the most salient points in its geology.

I may add that the bearings of the glacial *strial* were taken by Captain Duncan, of the steamer Princess; he had a compass with him on our second visit to this spot. I mention this because the markings here differ from some others in the Red River Valley. On these islands in many cases the glaciated surface of the rock is very marked and glistens like polished metal, when examined under the glare of the sun at noonday.

This varying of direction in the *striae* of the islands and those of Stony Mountain is an important fact and opens up a most interesting question for investigation by members of this society, viz:—What was the course of the glacier which swept over where Lake Winnipeg now is and pushed it away down the Red River Valley? It may have meandered considerably, while it ground out a basin for the lake and a course for the river; for we know in some cases among the Alpine districts now, glaciers are moving slowly through ravines which indicate a varied direction. Though no such irregular course is outlined by ravines in this lake region yet there may have been a time in the topography of the district under consideration when it was very different from what it is now. How interesting and important it is that the members of this society should collect all the data they conveniently can regarding these varying *striae* in the Red River Valley and among the islands of Lake Winnipeg. Keep a record of all information secured and in the course of time from the collected markings a fair outline of the course over which this river of ice glided can be made out out.

Without remarking further upon this interesting problem than to advise the society to keep it before the members I shall proceed to describe what I observed while examining Berens Island on the map, but better known to those who cross this lake as

SWAMPY ISLAND.

This place is sixty miles from Black Bear Island, in the main body of the lake, which here widens and forms a large expanse of water. The suspended mud of Red River is no longer seen coloring the waters of the lake, which are now clear and retain their purity throughout the whole distance to the

north shore. That the mud of Red River pollutes the waters of this lake for a distance of almost 100 miles is evidence of the exceedingly fine condition of the suspended clay in that river.

The island is about 15 miles in circumference and presents a more or less irregular shape. Irregularity of coast line is quite characteristic of these islands whose shores show exposures of limestone in thin layers.

Having spent four days on this lonely spot ample opportunity was afforded to examine the rocks along the coast On the south side of the island very little solid rock is in view, but immense piles of shingle form a sort of breakwater along the shore.

These fragments of stone are of all sizes from five inches long to small pebbles; the embankment extends for forty yards inland and is fully ten feet high. It shifts with every storm; at one time a large portion of it is forced along the shore and heaped into immense piles at one spot, where it remains until another storm sweeps them along to another on the coast. The whole barrier of shingle never disappears entirely but the greater part changes its position. A short time before my visit a violent storm occurred, which had shifted much of the shingle westward along the south shore. Behind this wall on the south-east side, is a large swamp, which no doubt accounts for the common name given the place; the water of this is influenced by the rise and fall of that in the lake, which shows that the centre of the island is about the same level as the lake. Sometimes during a storm the water in the swamp rises quite rapidly and subsides as soon as the wind falls. It is evident there is communication between the lake and swamp through the porous bank of shingle. Passing around to the north-east you find solid rock which at this point reaches the surface but farther inland it is buried beneath the shingle. The rock is in thin layers as observed at Black Bear Island. This explains how such great piles of small, circular, flat stones, (shingle) are formed. The upper thin layer becomes attached to the ice during the winter; when spring returns the floating ice lifts this and pushes it to the shore. Should a storm occur at this stage, one can readily understand how this large thin section of rock may soon be dashed to pieces and afterwards by the lashing of waves be gradually broken up and rounded into the shingle of the heaps that line the shore. It may be remarked here that the water in many places along the shore

is very shallow, so much so that even a row boat cannot be brought near the land without grounding upon the rocks. With such a shallow covering of water and rock in thin layers in a climate where the winter is long and severe, all the conditions are present to form material very rapidly, which, exposed to the storms that frequently and very suddenly appear on this lake, will be ground into rounded fragments of all sizes.

The portions which have not been exposed to much grinding, are readily distinguished from those that have been beaten about by the waves of many a storm; their corners have not become thoroughly rounded and their size is much larger than those of greater age. The shingle of this island is rich in fossils, but in many cases they are much water worn. They are much more numerous both in individuals and species than at any other place visited.

The genus Maclurea is found on every side; some very fine forms, indeed, measuring frequently five inches across, and some over six. Excellent specimens of these can be seen in the Provincial Museum.

From the rocks *in situ* very few fossils were taken. They could be cut out only with great difficulty, and their appearance usually much destroyed. Some idea of the fossil wealth in the layers of stone in this place may be understood when I remark that in a space 40 feet by 10 I counted nine Orthoceratites, three Maclurea, one Receptaculites, and two large forms of the genus Murchisonia.

Along the east side—the most fossiliferous part—of the island, where the rock reaches the surface, and very little water covers it for some distance, excellent examples of glacial *striae* are visible. Here, too, the markings indicate a north-east direction.

The boulders on this part of the island are very angular, and seem to indicate that they have not travelled so far as those we usually have seen in localities farther south.

The rock, resembling that of Black Bear Island, "*weathers*" very distinctly, and in many cases the fossils are in bold relief.

During my stay upon this somewhat desolate island I succeeded in finding a large number of interesting fossils, which may be identified as belonging to the following genera :—

PLANTAE.

Innumerable obscure forms of plant life belonging to some

genus of the Algae. In some cases these seaweeds were quite prominent on the *weathered* fragments of rock.

PROTOZOA.

Receptaculites. 6 specimens comparatively obscure.
Stromatopora. 3, one specimen well marked.

COCLENTERATA.

Holysites. Common, but much weathered.
Columnopora. 1, small form.
Zaphrenutis. Several.

ANNULOIDA.

The only representatives of this sub-kingdom are innumerable sections of the stems of Crinoids.

ANNULOSA.

A specimen of an almost complete trilobite, resembling, in some respects, the genus Calymene.

MOLLUSCA.

This sub-kingdom is well represented by the higher forms.
Orthoceras. Abundant and large.
Phragmoceras. 3; in which the body segments are distinct
Cyrtoceras. Several; no large forms.
Lituites. One obscure specimen.
Endoceras. Common, with position of the siphuncle indicated.
Maclurea. Exceedingly common and large. One fragment of rock 8 inches by 6 showed four specimens. This genus is characteristic of the limestone north, and seems to indicate a lower horizon than the deposits of Selkirk where Mr. McCharles and myself have found several.
Rhynchonella. 1; small form.
Strophomena. A few obscure forms.
Murchisonia. 2; one very well marked.

With such a display of extinct forms of life before us, the question naturally presents itself, to what formation do they belong?

They are, no doubt, fossils of the Silurian system. Regarding the formation, one hesitates to state their position; but they seem to belong to a lower horizon than the rocks at Selkirk, which we have seen fit to place as Trenton. This being the case, the fossils of the islands in Lake Winnipeg may be considered as belonging to a formation near the base of the lower Silurian system.

BEREN'S LANDING.

Before concluding this paper, permit me to direct your attention for a few moments to Beren's Landing on the mainland, almost directly east of Swampy Island. As you enter this place you are struck with the tortuous nature of the channel. Great outliers appear along the shores in striking contrast with the shallow places on the west side of the lake. This may be accounted for as follows :—

The limestone, if left as an outlier, soon wears away, and shallow water remains; while on the east coast, which is hard crystalline rock, if through long years of denudation it becomes cut off from the shores, it does not wear away readily, but remains as an immense rounded rock separated from the mainland. This recalls the appearance of the islands in Lake Muskoka and others in the district of the Laurentian system, studded with islands upon which time exerts but little influence. Hence the scarcity of islands in Lake Winnipeg, whose waters have to a great extent been wearing on a limestone bottom and shore.

Near the Hudson Bay Post at this place on the rocks which form the north bank of Beren's River, are excellent illustrations of glacial *striae*.

Immediately below the Fort they are north-east, but a short distance west they are north-north-east. Several observations were made, and all indicated a north east direction. These rocks are very smooth with rounded surface, and afford good examples of the so-called *Roches Moutonnees* of glaciated districts. This concludes a report of my investigations on Lake Winnipeg; if what has been written proves of interest to the Society, and adds to the already valuable information in its possession bearing upon the geology of the great Northwest, the writer has been amply repaid for the time and labor his work has entailed.